

## CLAIMS

1. A fuel cartridge, comprising:  
a fuel reservoir;  
5 a reaction chamber;  
an open region that connects the fuel reservoir to the reaction chamber; and  
a passive structure located within the open region adapted to resist fluid flow  
from the fuel reservoir to the reaction chamber.
- 10 2. A fuel cartridge as claimed in claim 1, further comprising:  
a fuel containing substance within the fuel reservoir.
- 15 3. A fuel cartridge as claimed in claim 2, wherein the fuel containing substance  
comprises sodium borohydride.
4. A fuel cartridge as claimed in claim 1, wherein the reaction chamber includes  
an inlet operably connected to the fuel reservoir and a gas outlet.
- 20 5. A fuel cartridge as claimed in claim 4, further comprising:  
a bi-product reservoir including a liquid inlet;  
wherein the reaction chamber includes a liquid outlet operably connected to  
the bi-product chamber liquid inlet.
- 25 6. A fuel cartridge as claimed in claim 5, further comprising:  
a substantially gas permeable/substantially liquid impermeable structure  
separating the reaction chamber liquid outlet from the reaction chamber gas outlet.
- 30 7. A fuel cartridge as claimed in claim 1, wherein the open region is defined by  
a tubular member.
8. A fuel cartridge as claimed in claim 1, wherein the passive structure creates  
capillary forces that resist fluid flow.

9. A fuel cartridge as claimed in claim 1, wherein the passive structure comprises a porous structure.

5 10. A fuel cartridge as claimed in claim 1, wherein the passive structure comprises a plurality of capillaries.

10 11. A fuel cartridge as claimed in claim 10, wherein the plurality of capillaries are substantially axially aligned with one another.

10 12. A fuel cartridge, comprising:  
a fuel reservoir including a fuel containing substance;  
a reaction chamber including an inlet, a gas outlet, a catalyst and a substantially gas permeable/substantially liquid impermeable structure separating the inlet from the gas outlet;  
an open region that connects the fuel reservoir to the reaction chamber; and  
a passive structure located within the open region adapted to creates capillary forces to resist flow of the fuel containing substance from the fuel reservoir to the reaction chamber.

20 13. A fuel cartridge as claimed in claim 12, further comprising:  
a bi-product reservoir including a liquid inlet;  
wherein the reaction chamber includes a liquid outlet operably connected to the bi-product chamber liquid inlet.

25 14. A fuel cartridge as claimed in claim 12, wherein the fuel containing substance comprises sodium borohydride.

30 15. A fuel cartridge as claimed in claim 12, wherein the passive structure comprises a porous structure.

16. A fuel cartridge as claimed in claim 12, wherein the passive structure comprises a plurality of capillaries.

17. A fuel cartridge as claimed in claim 16, wherein the plurality of capillaries  
5 are substantially axially aligned with one another.

18. A fuel cartridge, comprising:

a fuel reservoir;

a reaction chamber;

10 an open region that connects the fuel reservoir to the reaction chamber; and  
control means, associated with the open region, for passively resisting fluid flow from the fuel reservoir to the reaction chamber.

19. A fuel cartridge as claimed in claim 18, further comprising:

15 a fuel containing substance within the fuel reservoir.

20. A fuel cartridge as claimed in claim 18, wherein the reaction chamber includes an inlet operably connected to the fuel reservoir and a gas outlet.

20 21. A fuel cartridge as claimed in claim 20, further comprising:

a bi-product reservoir including a liquid inlet;

wherein the reaction chamber includes a liquid outlet operably connected to the bi-product chamber liquid inlet.

25 22. A fuel cartridge, comprising:

a fuel reservoir; and

a reaction chamber including a catalyst, an inlet operably connected to the fuel reservoir, a gas outlet and a substantially gas permeable/substantially liquid impermeable structure separating the inlet from the gas outlet.

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23. A fuel cartridge as claimed in claim 22, further comprising:

a fuel containing substance within the fuel reservoir.

24. A fuel cartridge as claimed in claim 23, wherein the fuel containing substance comprises sodium borohydride.

5        25. A fuel cartridge as claimed in claim 22, further comprising:  
            a bi-product reservoir including a liquid inlet;  
            wherein the reaction chamber includes a liquid outlet operably connected to  
the bi-product chamber liquid inlet.

10        26. A fuel cartridge as claimed in claim 22, wherein the reaction chamber comprises an external housing and the substantially gas permeable/substantially liquid impermeable structure comprises an enclosed structure in which the catalyst is at least partially located, an inlet operably connected to the fuel reservoir, and a liquid outlet.

15        27. A fuel cartridge as claimed in claim 22, wherein the reaction chamber external housing includes an inner surface, the enclosed substantially gas permeable/substantially liquid impermeable structure includes an outer surface, and a space is defined between the inner surface of the reaction chamber external housing and the outer surface of the enclosed substantially gas permeable/substantially liquid impermeable structure that is in communication with the reaction chamber gas outlet.

20        28. A fuel cartridge as claimed in claim 22, wherein the substantially gas permeable/substantially liquid impermeable structure comprises a porous hydrophobic membrane structure.

25        29. A fuel cartridge as claimed in claim 22, wherein the catalyst comprises a plurality of porous elements coated with catalyst material.

30        30. A fuel cartridge as claimed in claim 22, wherein the catalyst comprises a transition metal.

31. A reaction chamber for use with at least first and second reactants, the reaction chamber comprising:

an external housing defining a first reactant inlet, a liquid outlet and a gas outlet; and

5 a substantially gas permeable/substantially liquid impermeable structure located within the external housing that separates the first reactant inlet and the liquid outlet from the gas outlet.

32. A reaction chamber as claimed in claim 31, wherein the substantially gas  
10 permeable/substantially liquid impermeable structure comprises an internal housing formed at least partially from a substantially gas permeable/substantially liquid impermeable material and including an inlet operably connected to the external housing first reactant inlet and a liquid outlet operably connected to the external housing liquid outlet.

15 33. A reaction chamber as claimed in claim 32, wherein the second reactant is stored within the internal housing.

34. A reaction chamber as claimed in claim 32, wherein the external housing includes an inner surface, the internal housing includes an external surface, and a space is  
20 defined between the external housing inner surface and internal housing external surface that is in communication with the external housing gas outlet.

35. A reaction chamber as claimed in claim 31, wherein the substantially gas permeable/substantially liquid impermeable structure comprises a porous hydrophobic  
25 membrane material.

36. A device, comprising:

an apparatus that consumes electrical power;

a fuel cell, operably connected to the apparatus, including a fuel inlet; and

30 a reaction chamber including an inlet adapted to be connected to a fuel reservoir, a catalyst, and a fuel outlet connected to the fuel cell fuel inlet.

37. A device as claimed in claim 36, wherein the fuel cell comprises a fuel cell stack.

38. A device as claimed in claim 36, wherein the fuel cell comprises a PEM fuel cell.

39. A device as claimed in claim 36, wherein the reaction chamber includes a substantially gas permeable/substantially liquid impermeable structure separating the inlet from the fuel outlet.

10 40. A device as claimed in claim 39, wherein the reaction chamber includes a bi-product outlet separated from the fuel outlet by the substantially gas permeable/substantially liquid impermeable structure.

15 41. A device as claimed in claim 40, wherein the fuel reservoir is associated with a fuel cartridge that includes a bi-product reservoir, the device further comprising:

a first connector operably connected to the reaction chamber fuel inlet and adapted to be connected to a fuel cartridge fuel outlet connector; and

20 a second connector operably connected to the reaction chamber bi-product outlet and adapted to be connected to a fuel cartridge bi-product inlet connector.

42. A device as claimed in claim 36, wherein the fuel reservoir is associated with a fuel cartridge, the device further comprising:

25 a connector operably connected to the reaction chamber fuel inlet and adapted to be connected to a fuel cartridge fuel outlet connector.

43. A device as claimed in claim 42, further comprising:

30 a passive structure located between the connector and the reaction chamber fuel inlet and adapted to resist fluid flow from the fuel cartridge to the reaction chamber fuel inlet.

44. A device as claimed in claim 36, further comprising:  
a pump including a pump inlet associated with the catalyst chamber fuel outlet and a pump outlet associated with the fuel cell fuel inlet.
- 5 45. A device as claimed in claim 36, further comprising:  
a device housing substantially enclosing the apparatus and the fuel cell and defining an overall size that allows the device housing to be held in a user's hand.
- 10 46. A method of controlling the flow of a reactant to a reaction chamber, comprising the steps of:  
preventing the flow of the reactant to the reaction chamber with a passive structure that opposes the flow of the reactant to the reactant chamber; and  
creating a sufficient pressure gradient across the passive structure to cause the reactant to flow past the passive structure to the reaction chamber.
- 15 47. A method as claimed in claim 46, wherein the step of preventing the flow of the reactant to the reaction chamber with a passive structure comprises applying capillary force to the reactant.
- 20 48. A method as claimed in claim 46, wherein the step of creating a sufficient pressure gradient across the passive structure comprises drawing a reaction product out of the reaction chamber.
- 25 49. A method as claimed in claim 46, further comprising the step of:  
supplying the reactant from a removable cartridge with a reactant reservoir located upstream from the passive structure.
- 30 50. A method of supply a gaseous fuel to a fuel consuming device, comprising the steps of:  
supplying a fuel containing substance to a reaction chamber that includes an inlet, a catalyst that causes the fuel containing substance to produce the gaseous fuel and a

liquid bi-product, a gas outlet, and a substantially gas permeable/substantially liquid impermeable structure separating the inlet from the gas outlet; and

connecting the gas outlet to the fuel consuming device.

5 51. A method as claimed in claim 50, further comprising the step of:  
          storing the gaseous fuel between the substantially gas  
permeable/substantially liquid impermeable structure and the gas outlet until the gaseous  
fuel is required by the fuel consuming device.

10 52. A method as claimed in claim 50, wherein the reaction chamber includes a bi-product outlet separated from the gas outlet by the substantially gas permeable/substantially liquid impermeable structure, the method further comprising the step of:

connecting the bi-product outlet to a bi-product reservoir.

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